Presentation to Soils and Crops 2000
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"Opportunities for the Expansion of Ethanol Production In Western Canada"

A renewed interest in ethanol production in North America is occurring because of: (1) higher gasoline prices which have improved the viability of ethanol investments; (2) commitments by Canada, the U.S., and other nations to reduce greenhouse gas emissions; (3) opportunities for rural employment through additional value added industry; and (4) a desire to reduce burdensome grain stocks and thus assist in the ultimate recovery of grain prices benefitting all agricultural producers. Changes in transportation costs for export grain in Western Canada provide a further incentive promoting the ethanol industry. This paper summarizes some of the developments and issues relating to the expansion of ethanol production in Western Canada.

Among the issues for those interested in ethanol have been: (1) Is this industry likely to be viable and to compete with other fuel sources, particularly gasoline? (2) Does the industry require ongoing incentive schemes in order to compete? (3) Does the industry require additional incentives in order to assist Canada in reducing greenhouse gas emissions? (4) How effective is ethanol in reducing greenhouse gas emissions?, and (5) Is the expansion of ethanol production effective in reducing grain carryovers to help stabilize grain prices?

None of these questions have complete or absolute answers, but additional research and experience is shedding light on these issues**.**

Ethanol Viability

An earlier study of the ethanol industry concluded that current incentives for ethanol production in Canada were sufficient for the expansion of the industry in those provinces offering incentives in addition to the federal excise tax exemption of 10 ¢ per litre (Clark, 1994). Manitoba and Saskatchewan were the first provinces to offer incentives. The concern of the investors in the ethanol industry was their likelihood for survival**,** if, and in the case of Saskatchewan, when the provincial incentives were discontinued. While the incentives in Saskatchewan were designed to help the industry get started initially, the industries in both provinces have been successful. The Manitoba program continues to provide direct assistance of about 25 ¢ per litre.

The Saskatchewan ethanol producer indicates that approximately 10 ¢ per litre is required to cover the fixed costs of investment. This is equivalent to the federal incentive, but would leave new companies without a strong reason for investing in the province when additional incentives are available elsewhere.

Alberta has extended a full road tax exemption of 9 ¢ per litre of ethanol, and has benefited by the opening of one additional ethanol plant in Red Deer (API), with others in various stages of planning. Alberta also enjoys the benefit of gas pipelines extending to markets in the U.S., which reduce transportation costs for ethanol blends or ETBE (an oxygenate[1] derived from ethanol) to that market.[2] Since Alberta has a greater population than either Saskatchewan or Manitoba, it also has the opportunity to market up to three times the amount of ethanol in its own province (taking advantage of the provincial incentive) as could be produced in each of the other two provinces on the basis of local demand alone.

Demand for ethanol in Western Canada is further inhibited because most gasoline distributors do not promote ethanol blends to reduce displacement of their own product. In Ontario, however, where there is a strong need to reduce greenhouse gas emissions for environmental reasons, the full road tax exemption of 14.7 ¢ per litre provides a greater profit potential for ethanol blends sold in that province. This encouraged Commercial Alcohols to construct a 150 million litre per year ethanol plant (as compared to capacities of 10, 12 to 14, and 18 to 23 million litres for plants in Manitoba, Saskatchewan, and Alberta respectively).

The greater availability of and improved incentives for ethanol in Ontario is encouraging retailers to offer ethanol blends in all grades of gasoline at the same price as conventional gasoline. Currently, the incentive for ethanol in Manitoba allows that province to price ethanol blends comparable to regular gasoline. In Alberta, Saskatchewan, and British Columbia, Mohawk/Husky Oil is pricing ethanol blends at premiums of 5 ¢ per litre to regular gasoline. The road tax exemption of 9 ¢ a litre in Alberta is viewed as insufficient to allow ethanol blends to be priced similar to gasoline within the province. British Columbia has an 11 ¢ per litre road tax, and offers an incentive for ethanol production from wood chips if the ethanol is produced in province. To date technology has not advanced far enough to make this option attractive to investors.

Commercial Alcohols estimates the cost of ethanol production to be about 35 ¢ to 45 ¢ per litre. If Saskatchewan wheat feedstock prices are $90/tonne,[3] and one tonne of wheat produces about 362

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[1]An oxygenate is a fuel additive which increases the oxygen content of gasoline, thereby allowing it to burn more cleanly, reducing greenhouse gas emissions.

[2]It is unlikely that ETBE will be produced now as an oxygenate, since ETBE may be toxic, and the seepage of MTBE into water supplies in the U.S. leaves investors unwilling to risk a similar scenario if ETBE should have similar problems.

[3]Poundmaker uses a discount of 35 under the Thunder Bay feed wheat futures in most years to price its feedstock, although current prices are 40 under. This is equivalent to the local price for feed

litres of ethanol, the cost of the feedstock alone would equate to 25 ¢ per litre. If wheat prices were $130/tonne (as in December of 1997), then the cost of the feedstock would equate to 36 ¢ per litre. If the combination of co-product values and the fixed costs of the plant are about 10 ¢ per litre (Wildeman 1999), then the range of cost of production for ethanol from wheat in Saskatchewan is almost identical to the Chatham corn/ethanol plant.

Table 1 compares an estimate of ethanol margins for corn in Chicago and Ontario, for wheat in Saskatchewan, and for barley in Alberta over the past two years. Ethanol prices are assumed to be comparable in Chicago and in Ontario. The ethanol price in Alberta and Saskatchewan is estimated to be 1.5 ¢ per litre below the U.S. price, due to transportation costs.

Multiplying the recent ethanol price of 46 ¢ per litre (less 1.5 ¢ for transportation) by the conversion ratio of 362 litres of ethanol per tonne of wheat, and dividing by the $90/tonne cost of wheat in Saskatchewan provides an ethanol profit margin of 79% (which must account for fixed costs minus co-product values). If this ethanol margin were to fall dramatically due to rising feedstock prices without a similar rise in ethanol prices, then the plant would be forced to slow down or cease production temporarily. It should be noted that all of the margins have been positive over the past two years in all major locations for all feedstocks, and that Saskatchewan, in general, competes well with the other locations.

Ethanol production should survive in Saskatchewan without further incentives, but further expansion in the industry is not likely to occur here without incentives comparable to Alberta or Ontario. A partial ethanol road tax exemption of 5 ¢ to 10 ¢ cents per litre might be sufficient to encourage further expansion in the industry, but would be unlikely to induce a reduction in the price of ethanol blends sufficient to encourage further ethanol use.

Greenhouse Gases

A recent study by Levelton Engineering(1999) concluded that 10% (E10) ethanol blends with gasoline will reduce greenhouse gas emissions by about 3.9% compared to regular gasoline. Since ethanol is only 10% of this blend, the ethanol improvement in reducing greenhouse gas emissions is about 39%.

A U.S. study by Wang et al (1999) concluded that current corn based ethanol technology and the use of 10% ethanol blends reduces greenhouse gas emissions by 1%. This improves to a reduction of 2% using the most recent ethanol production technology. With the production of ethanol from cellulosic feedstock, however, the use of 10% ethanol blends reduces greenhouse gas emissions by 6 to 9% compared to gasoline. Greenhouse gas emissions are reduced proportionately more with 85% or 95% ethanol blends.

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wheat which will be higher than export prices in years of depressed export markets. Ethanol production expands the market for feed wheat.

It would appear that major reductions in greenhouse gas emissions come with higher percentage ethanol blends and by producing ethanol from cellulosic material. This may suggest that incentives for ethanol consumption should be based on its environmental benefits, therefore increasing the benefit to cellulose based ethanol and higher percentage ethanol blends.

Canadian technology to convert cellulose will be demonstrated later this year at Iogen Corporation's pilot plant located in Ottawa. Commercial plants may therefore be three to five years away. U.S. based technology will be demonstrated within the next two years, with commercial scale plants likely to be operational within the same three to five years.

Does the industry require further incentives to reduce greenhouse gas emissions? Further incentives of about 15 ¢ per litre (ie. in addition to the federal exemption of 10 ¢ per litre) could encourage distributors to offer ethanol blends at similar prices to gasoline throughout Western Canada. This should lead to a greater usage of ethanol. Wide scale availability of 85% ethanol blends is unlikely due both to the threat this would represent to the gasoline industry, and to a lack of sufficient supplies of ethanol.

Ethanol Pricing

A rough estimate of ethanol prices can be obtained by taking the closing prices of gasoline futures quoted on the New York Mercantile Exchange, converting to Canadian cents per litre, and adding the tax exemptions of 10 ¢ per litre federally, and the Alberta road tax exemption of 9 ¢ per litre. For instance a recent close of $0.80 U.S. per gallon equates to a Canadian gasoline price of about 31 ¢ per litre, or an ethanol price of about 50 ¢ per litre. Many ethanol supply agreements are based on the current price of gasoline, and therefore fluctuate daily.

In the U.S. it would also be possible to use the New York closing price for gasoline and add the U.S. federal exemption of $0.54 per gallon. A gasoline price of $0.80 U.S. per gallon equates to a U.S. ethanol price of about $1.34 per gallon, or 51 ¢ Canadian per litre.[4] U.S. prices for ethanol have dropped below $1.00 U.S. per gallon in times of oversupply and depressed grain prices, while Canadian ethanol prices have ranged from 40 ¢ per litre to about 50 ¢ per litre for large quantities, and up to 60 ¢ per litre for smaller quantities.[5]

On February 4, 2000, U.S. ethanol prices averaged $1.20 U.S. per gallon (or 46 ¢ Can/litre),[6] while Canadian prices FOB Red Deer were 47 ¢ per litre.[7] Ethanol prices vary throughout the U.S., but some Canadian ethanol is being exported south. Prior to the Commercial Alcohols plant reaching full

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[4]1 U.S. gallon = 3.785 litres; 1 U.S. $ = $.69 Can.

[5]Price quote by Commercial Alcohols.

[6]Personal communication, courtesy of Jim Evangelow, *Chemical Strategies*, New York.

[7]Personal communication, API Grain Processors, Red Deer, AB.

production, U.S. ethanol was also imported into Ontario.

Effect on Grain Prices and Supply

The current production capacity of ethanol in Western Canada is about 47 million litres. This would require a feedstock of about 130,000 tonnes of wheat. With a carryover of about 6 million tonnes in 1999/2000, an increased usage of this amount could reduce the stocks to usage ratio from 27% to 26%. With current wheat feedstock prices of about $90/tonne, a doubling of the current ethanol capacity could increase wheat prices by about $3.50 per tonne, if wheat were the only feedstock.[8]

In Eastern Canada the effects of ethanol production appear more significant. With a capacity of about 170 million litres, it requires about 456,000 tonnes of corn to supply the current ethanol industry with feedstock. This is about half the current carryover of corn in Canada. U.S. corn is imported to make up any shortage. The current price of corn in Ontario is about $108 per tonne, about $2 per tonne below last year.[9] The average U.S. corn price in the current year is estimated to be about $1.90 U.S. per bushel, or about $108 Canadian per tonne, down from about $1.94 U.S. per bushel last year, or about $117 Canadian per tonne.[10] U.S. corn prices have dropped by $9 Canadian per tonne, but Canadian corn prices have only dropped by $2 per tonne. The influence of the increased ethanol demand on corn prices in Ontario could be as much as $7 a tonne. The Ontario corn carryover is a minimal 8% of usage, or a bare pipeline supply, while the U.S. carryover is about 18% of usage (Clark, 2000).

In a highly populated area the increased use of ethanol appears to have a significant influence on grain prices. In Western Canada the increased production of ethanol would likely require additional exports to the U.S.

The possibility of exporting ethanol to the U.S. depends on several factors: (1) Whether these exports will be charged the U.S. incentive of 54 ¢ per gallon;[11] (2) A decision pending by California and the U.S. government as to whether California will be allowed an exemption from using oxygenates (such as ethanol) in its reformulated fuels under the U.S. Clean Air Act; and
(3) The extent by which incentives offered for ethanol production in corn producing states could reduce U.S. ethanol prices below the levels at which Canadian ethanol could compete.

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[8]Assuming p1*q1 = p2*q2, where p1, p2, and q1, q2 are the respective prices and quantities in the current and extrapolated scenarios.

[9]Market Analysis Division, *Weekly Price Summary*.

[10]Corn price estimates are quoted by the U.S. Department of Agriculture in their monthly supply/demand reports. See http://www.fbminet.ca/bulletin/fbmbul108.htm.

[11]In theory Canadian ethanol exports to the U.S. should be taxed by the amount of this incentive. In practise with a small amount exported this may not be the case. A significant increase in Canadian ethanol exports could raise the specter of U.S. protectionism.

At the moment the potential for the expansion of ethanol production in eastern Canada appears more promising due to the commitment to exemptions from provincial road taxes by both Ontario and Quebec. Western Canada's ethanol production is slowly expanding, but remains impeded by the lack of commitment to the distribution of ethanol blends by major oil companies, and by insufficient incentives to encourage the consumption of ethanol at retail prices similar to gasoline in all provinces.

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